Flash Flood Monitoring and Prediction (FFMP)

Guide for Users

version OB1

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NWS - MDL

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Introduction

The Flash Flood Monitoring and Prediction (FFMP) system is an integrated suite of multi-sensor applications which detects, analyzes, and monitors precipitation and generates short-term warning guidance for flash flooding automatically within AWIPS. FFMP will provide forecasters with accurate, timely, and consistent guidance and supplement forecaster event monitoring with multi-sensor, automated event monitoring. The intended benefits are:

- ☼ Longer lead times on warned events
- ☼ Fewer missed events
- ☼ Increased forecaster situational awareness
- ☼ Reduced forecaster fatigue during warning situations

Changes from FFMP 1.0 (AWIPS 5.0):
There have been several significant changes from FFMP (1.0) in AWIPS B5.0 and FFMP (2.0) in AWIPS B5.1.2. The most basic difference is the resolution of the hydro-geographic base data. The basins on which the hydrometeorological analyses are conducted are on the order of 2 to 10 square miles, much smaller than the MAP basins used in FFMP 1.0, which had areas on the order of 50 to 100 square miles.

A major consequence of the better resolution of this base data is a much larger amount of data to deal with and graphically display. Keeping older methods from FFMP 1.0 would mean workstation and server performance well below current levels. Thus, another consequence of the better resolution base data is a significant re-design of FFMP.

A key element of the re-design is the implementation of progressive disclosure. Both the FFMP image on the D2D and the graphical Basin Table begin with county-centric data. The user can then focus on a specific county to obtain the data for the small basins within that county. Please read below for instructions on how to investigate a specific county.

Another big change involves the FFMP load menu selection. The older version of FFMP had many menu selections, one for each time frame (1, 3, 6 hour) and type (accumulation, difference, ratio). All of these options have been combined into one selection. These variables can be controlled by the Basin Table and refreshing the D2D image.

NOTE: County values are calculated by determining the maximum value of all of the basins within that county, except for FFG, which is averaged for all basins within that county.

Requesting the FFMP Suite

Under the SCAN menu will be selections for each dedicated radar. Each of these radar selections has the available FFMP products (as well as other SCAN products).

FFMP consists of a flexible image depictable, several FFG image depictables, and an extension with associated Graphical User Interface (GUI). To load FFMP, select "FFMP Image / Basin Table" for the radar of interest. This will load the FFMP Small Basin image in the D2D and load the Basin Table GUI (but will not load any FFG data). A small loading image will appear on the lower left part of the screen while the Basin Table GUI is being created. If there is no data to display, you will be informed and FFMP will not load.

The D2D

Once the FFMP suite is loaded, on the D2D you will see a county map. If sufficient precipitation has fallen in the specified time frame, the counties in the CWA will be color-filled. The small legend in the upper left corner of the pane will display the time frame (in hours) and attribute used to create the display. The Basin Table will appear in front of the D2D. (See Figure 1)

The FFMP Basin Table Constituents:

See Figure 1.

The Menu/Information Bar

Contains the File Menu and information regarding the link to the D2D and the valid time of the FFMP Basin Table.

The File Menu

Retrieve Default Configuration	Retrieves and uses the default basin configuration file.
Retrieve Configuration...	Retrieves and uses a specified basin configuration file.
Save Configuration	Saves the basin configuration file.
Save Configuration As...	Saves the basin configuration file to a new file, defined by the user.

Link to Frame

Indicates whether the valid time in the FFMP Basin Table will always match the time in the D2D frame. If this button is activated and the user changes the frame in the D2D, the basin table will update to match the data shown on the D2D. If this is off, the data in the basin table will represent the *most*

recent inventory time.

Ending Time
This displays the UTC time for which the data in the basin table is valid. This is the beginning of the volume scan for which the pertinent time duration ends.

The Options Buttons

Below the Menu/Information bar and above the body of the basin table.

Refresh D2D

This button will allow the D2D to see any changes made to the way data is displayed in the basin table, thus updating the D2D image to reflect the data in the basin table. For example, if you wish to change the duration in the D2D FFMP image, you first change the duration in the basin table (see below), then left-click the Refresh D2D button and the image in the D2D will change its duration to what was just selected in the basin table. This button will change color if something has changed in the Basin Table that would require the FFMP display in the D2D to be updated in order for the two display components to agree.

Thresh Type

Both the basin trends (see below) and the D2D FFMP images are color-coded based on the type of threshold the user wants to view. The choices of threshold type are: precip (accumulation), diff (accumulation minus FFG), and ratio (accumulation divided by FFG). This button displays the current threshold type chosen. If you wish to change this, left-click on this button and make a different selection. The basin table will update. If you wish to have the D2D update as well, left-click the Refresh D2D button (as described above).

Data Sources

This menu button lists all precipitation data sources available for use in the table. The precipitation source selected is used in computing the ratio and difference values in the table. Currently, only the Digital Hybrid Reflectivity (DHR) radar product is available, but future enhancements may include precipitation data from rain gages or QPFs.

County

This button reflects what kind of data is being listed in the table. If the text on the button is "County List" and greyed out, the list in the table is a county list. If the list in the table is a basin list, this button will provide the county name and a means for returning to the county list. If a basin list is displayed, but the user wishes to return to a county list, simply left-click this button.

Durations

The raw FFG received from the RFCs exists for the one, three, and six hour time duration. From these

base values, FFG can be interpolated or extrapolated to other time frames. A new time frame can be chosen by left-clicking on the "Duration" button and selecting one of the durations listed. Once one of the durations is selected, the current table will be updated to display the data only for the new requested duration without destroying the entire window. The current duration is printed on the "Durations" button.

The Attribute Title Row

Shows (in black) what attributes are available for viewing. When the cursor is focused over these titles, a tip text pop-up will appear, describing what button click actions will trigger what functionality.

Ranking By Attribute

Left-clicking on applicable attribute titles will sort the table data according to that attribute. A purple attribute button background color signifies that this attribute was the last attribute to be used for sorting the table data. Refer to Appendix A to see for which attributes the table can be ranked.

Changing the Attribute Color Thresholds

Right-clicking on applicable attribute titles will bring up the Attribute Color Threshold (ACT) window. The ACT window allows the user to define value ranges of each applicable basin attribute. These value ranges are intended to reflect the degree of strength of the attributes, from green (weak) to yellow (moderate) to red (strong). Refer to Appendix A to see which attributes can be multi-colored.

The Table Body

Displays the basin or county information, including such attributes as precipitation estimate and comparisons to Flash Flood Guidance. If there is no rainfall over all geographic entities for the specified precipitation data source and time duration, the data presented in the table will have error values (ie: "na"). The values for the various basin attributes are displayed in the table body and color coded (when applicable) according to the attribute color thresholds defined in the ACT window. Also, when the cursor focuses over an area identifier, the full name of the area will appear in a text pop-up box. Refer to Appendix A for a list of all basin attributes available through FFMP.

Inspecting a Basin or County

Left-clicking on an identifier in the 'area_Id' column will cause the D2D to zoom-and-recenter on that particular county or basin. If the list is a county list, the D2D will zoom in on that particular county and display the basins within that county only, and the data for the basins within that county will be listed in the Basin Table. If the list is a basin list, the D2D image will zoom in further than the zoom for a county, fill the Inspection Row with data for that basin, and highlight that basin's identifier in the 'area_Id' column. The Inspection Row can be seen in Figure 1.

The Inspection Row

Duplicates the row in the table body for the basin that was last inspected (see the section on basin inspection under the "Table Body" topic for instructions on how to inspect a basin). This row emphasizes the data for the identified basin last inspected via the zoom-and-recenter method. The individual grid boxes in the Inspection Row have the same capabilities as the grid boxes in the table body, except left-clicking on the identifier box will zoom the D2D back out to the zoom level defined on the D2D menu bar. See Figure 1.

Zooming Back Out

Left-clicking on the identifier in the 'area_Id' column will cause the D2D to zoom back out (after zooming in on a basin) to the single-county view, but retain the basin listing in the Basin Table.

FFMP Basin Table Sub-GUIs in Detail

Attribute Color Threshold (ACT) Window

Launched from the Attribute Title Row. The user can edit the color-coded strength values for any of the basin attributes displayed in the Attribute Title Row.

"Attribute:"	The user can switch to a different basin attribute. The units of the attribute will also appear on this button.
"Upper:", "Mid:", "Lower:"	The strength thresholds, corresponding to the attribute values that meet or exceed these threshold values.
"Apply"	The user accepts the changes just made and closes the window.
"Cancel"	The user can discard the changes just made.

Basin Trend Graph

A Basin Trend Graph can be produced by right-clicking on the basin identifier (for a basin list). It can also be produced by enabling the "FFMP Table Display" in the D2D (right click on the legend of the same title) and right clicking over a basin. The way the data is displayed in the Basin Trend Graph may take a bit of time to get used to. Here's an example of interpretation for the "3.0" point on the x axis: the rate plot represents the instantaneous precipitation rate for the volume scan with beginning time of 3.0 hours in the past; the accumulation plot represents the amount of precipitation that has fallen in the past 3.0 hours; the FFG plot represents the Flash Flood Guidance valid for the 3.0-hour time frame. The colors under the accumulation plot represent the degree of urgency with which the basin should be investigated. The color thresholds and the attribute to which the thresholds will be applied are presented in the color legend at the bottom of the GUI and can be chosen via the ACT window and the Threshold Type Selector, both available in the Basin Table itself. See Figure 2 for an example of a

Basin Trend.

FFMP Flash Flood Guidance

The FFMP provides a D-2D display of the gridded Flash Flood Guidance data issued by the River Forecast Centers (RFCs). This is the same data that is currently available in the Surface menu (under "RFC FFG/QPE/QPF images"). While the Surface menu selection will let you choose FFG data from individual RFCs or a national mosaic, the FFMP display will mosaic data from all RFCs that have coverage over the local small stream basins. Instead of using a single inventory time, the FFMP display will mosaic the latest FFG data from the selected RFCs, even if the inventory times are different, provided that the data is no older than 36 hours.

FFMP Flash Flood Threat Index (FFTI)

Under the WarnGen button on the D2D, there are several buttons. One, marked by "FF" is the FFMP Flash Flood Threat Indicator. The color of the FFTI indicator will represent the value of the chosen attribute. The attributes to choose from are: precipitation accumulation derived from the DHR radar product ("dhr"), the ratio of the precipitation accumulation to the FFG, and the difference between the precipitation accumulation and FFG. You may choose which attribute and what time frame to monitor and the color thresholds used for the FFTI button by left-clicking on the "FF" button. This will bring up the FFTI Change GUI (see Figure 3). If you place the mouse cursor over this button, some text will pop-up, providing some additional information, such as what is being monitored and for what time frame.

The colors and what they represent are:

- **White** indicates little or no activity in the CWA.
- **Green** indicates precipitation in the CWA.
- **Yellow** indicates moderate precipitation estimates in the CWA.
- **Red** indicates heavy precipitation estimates in the CWA.
- **Grey** indicates an invalid index number, which means the FFMP processor is not behaving properly or data is missing.

What's New in OB1?

- The county list in the Basin Table now shows the county name with the state abbreviation, with the FIPS codes available via sampling. (It used to be the other way around.)
- The Refresh button in the Basin Table will now be highlighted if something has changed in the Basin Table that would require the FFMP display in the D2D to be updated in order for the two display components to agree.
- The legend in the Basin Trend window now shows the specific threshold ranges for the colors.

- ☼ The Basin Trend FFG plot has been given the ½ hour extrapolated value at the zero point.
- ☼ When FFMP gets loaded, if there are no data files to read, a message window will pop up and tell you so.
- ☼ The text pop up from the FFTI button now includes the time frame being monitored.

Data Monitoring System (DMS)

The FFMP Data Monitoring System (DMS) is a web browser-based, automated system for monitoring the status of the vital components of FFMP. It consists of a suite of HTML files, a Tcl/Tk Common Gateway Interface (CGI) script, and various supporting procedure, data, and image files. The system is housed on a web server, accessed through any browser that supports frames, and is updated using the CGI script. The following information is intended to give an overall description of the system display, defining the layout and components, and provide instructions for using the system.

DMS Display

See Figure 4.
The FFMP DMS display is divided into two frames. A small, static frame at the top of the page holds the title information and the button for updating the table information. The main frame below houses the data monitoring graphical elements.

Radar Products Information Table
The Radar Products Information table monitors the status of the DHR radar product for each dedicated radar. For each dedicated radar, the monitor reports whether or not the DHR product is on the Routine Products Set (RPS) list (Y for Yes, N for No), and gives the most recent GMT inventory time. If the DHR product is absent from the RPS list, the background of the table cell containing the letter "N" will be colored red. If the DHR product is not available, meaning there is no data file in the directory where it is stored, the monitor reports "None" and colors the background of the table cell red. Similarly, if a data file time is old, the background of the cell is colored red. A file is determined to be old according to a formula derived from the VCP mode (twice the length of the volume scan plus 2 minutes). If the VCP mode is not available, the default threshold value of 22 minutes is used.

Flash Flood Guidance Information Table
The FFG Information table monitors the status of FFG products for each River Forecast Center (RFC) that has responsibilities within the WFO's CWA. For each time period, and for each RFC, the monitor reports the most recent GMT inventory time. If the product is not available, meaning there is no data file in the directory where it is stored, the monitor reports "None" and colors the background of the table cell red. Similarly, if a data file time is old, the background of the table cell is colored red. A file is determined to be old if it is older than 36 hours.

Using the DMS

Loading the DMS

The file name to enter into the browser address line is http://as1f/infoPages/FFMP_DMS.html.

Updating the Information: Automatic and Manual

In the static frame at the top of the display, there is a blue button labeled "UPDATE INFO." Clicking this button will refresh the information displayed in the lower frame. Also, for convenience, the DMS is equipped with an automatic update feature. This feature allows the user "hands-free" monitoring, updating the information automatically every two minutes.

Figures

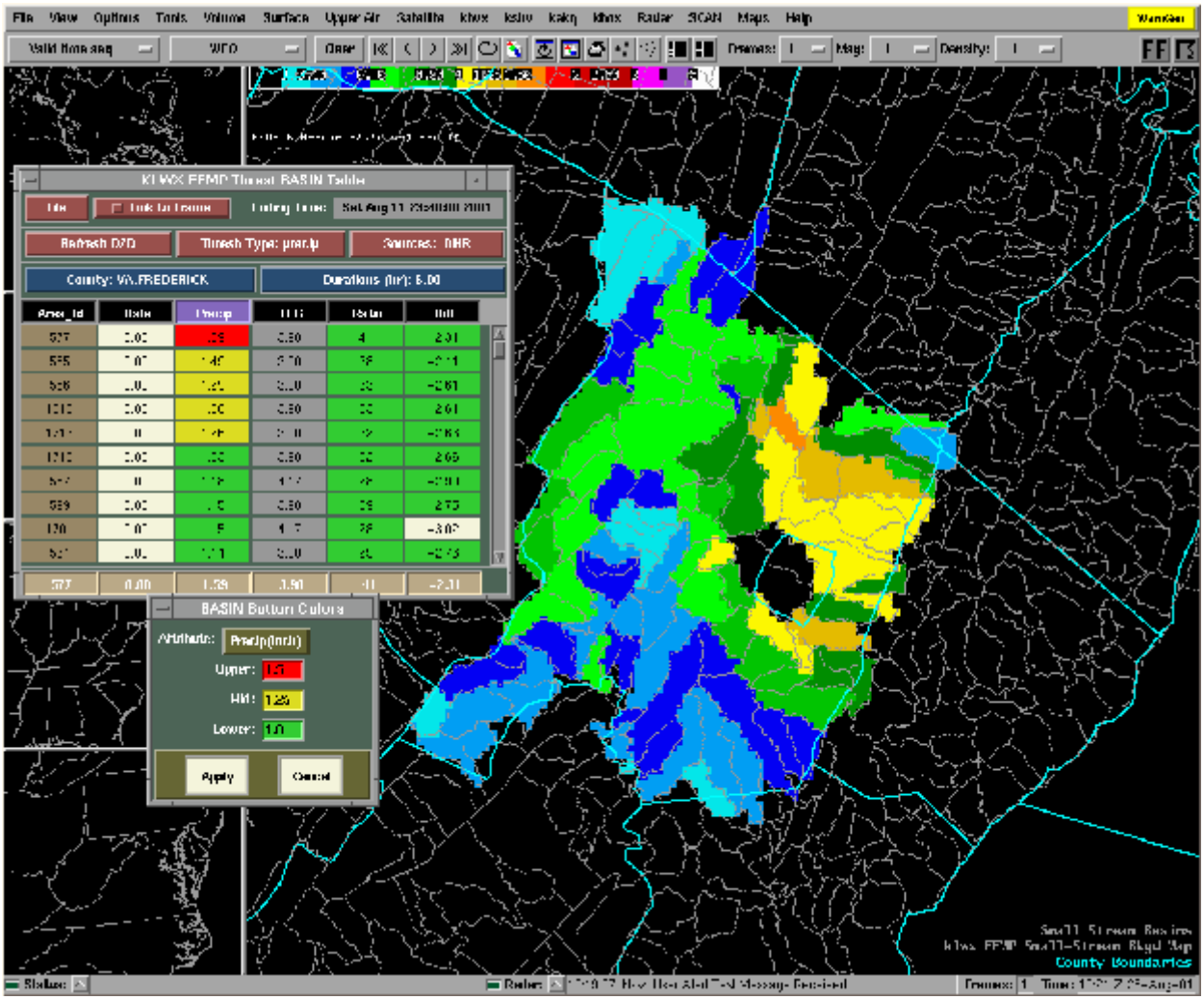

Figure 1 This shows the FFMP Basin Table and Button Color Threshold GUI with the D2D. The D2D shows the FFTI indicator below the WarnGen button. It also shows a view of the basin data in one county.

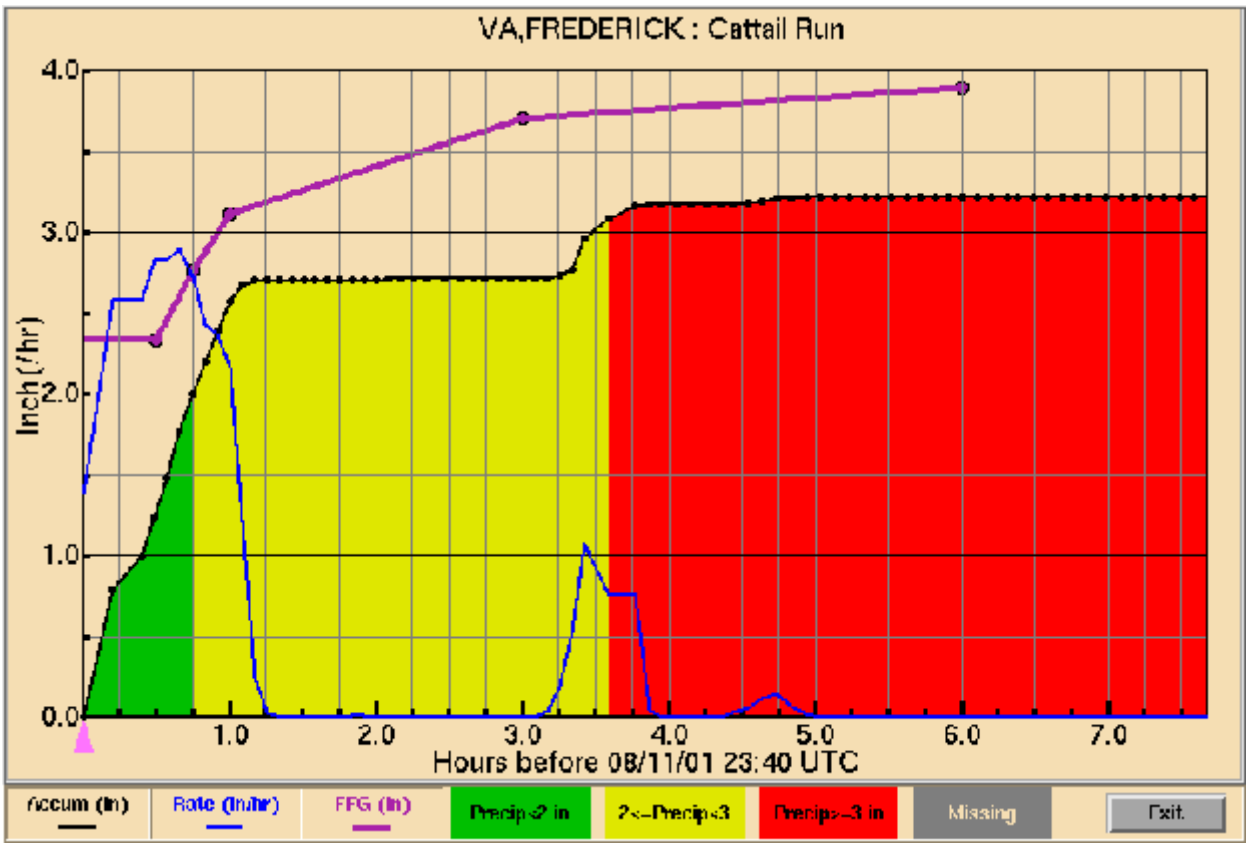

Figure 2 This is a Basin Trend. Please take time to examine this trend to fully understand what it is showing. The "Rate" plot represents the 'instantaneous' rate determined from the DHR radar products, backwards in time. The "Accum" represents the precipitation accumulation for the specified number of hours in the past to the most recent data time. The "FFG" plot is the valid Flash Flood Guidance for the specified time frame (not the number of hours in the past), thus the comparability to the accumulation plot.

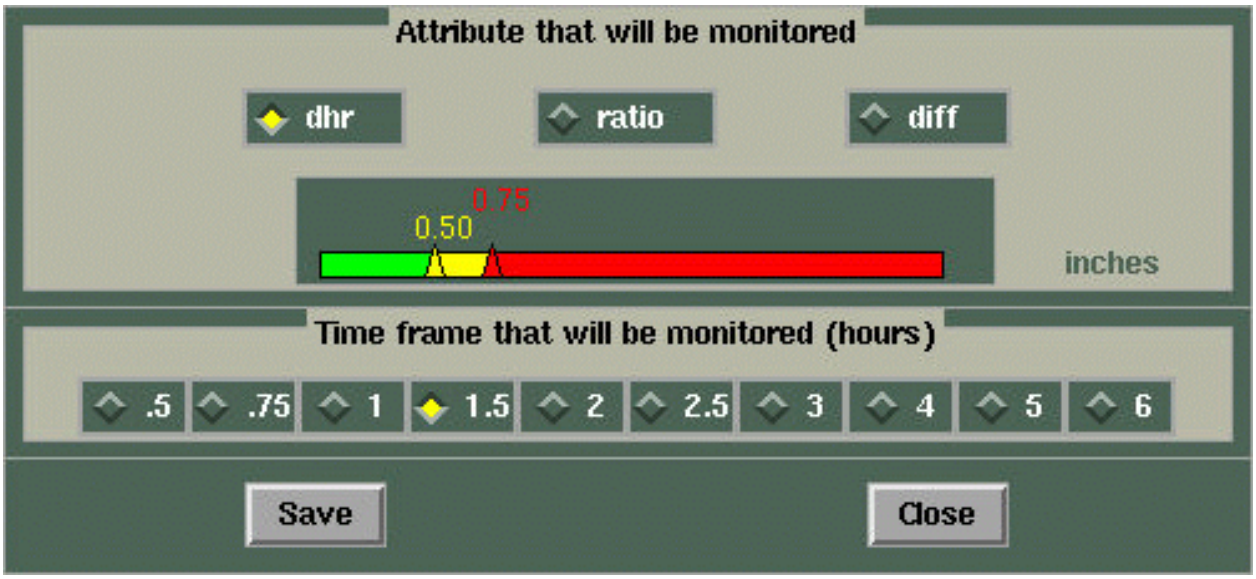

Figure 3 This is the FFTI Change GUI, rendered by left-clicking on the "FF" button below the WarnGen button on the D2D.

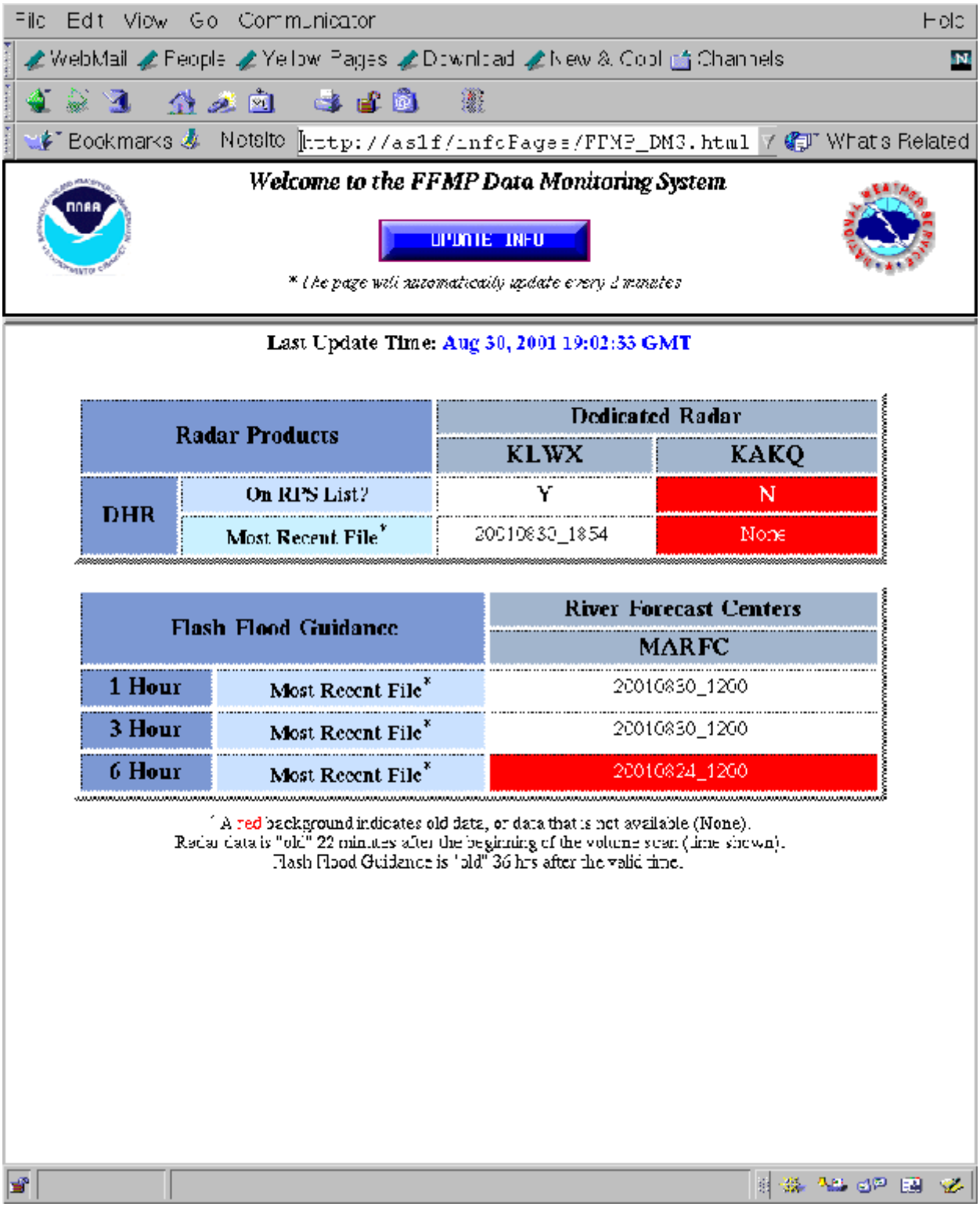

Figure 4 The FFMP web Data Monitor, showing the availability of the DHR product and Flash Flood Guidance from all sending River Forecast Centers.

Help

To report problems or ask questions concerning the operation of FFMP in general, please contact Tom Filiaggi at (301)713-1774 x180 or email at Tom.Filiaggi@noaa.gov (as of 08/2001) or use the awipsinfo list server.

Glossary

ACT - Attribute Color Threshold

CGI - Common Gateway Interface

CWA - County Warning Area

D2D - Display 2 Dimensions

DMS - Data Monitoring System

DHR - Digital Hybrid Reflectivity

Depictable - A method to retrieve data and display it using AWIPS and the D2D.

Extension - A depictable that allows user interaction with the D2D displays.

FFMP - Flash Flood Monitoring and Prediction

FFTI - Flash Flood Threat Indicator

GUI - Graphical User Interface

RFC - River Forecast Center

RPS - Routine Products Set

VCP - Volume Coverage Pattern

Appendices

Appendix A FFMP Table Attributes for Counties and Basins

Attribute	Definition	Units	Can be used for ranking?	Can be multi-colored?
area_Id	County or Basin Identifier	15 letter ID	Yes	No
rate	Precipitation Rate.	Inches per Hour	Yes	Yes
precip	Average precip. for GeoArea.	Inches	Yes	Yes
ffg	Flash Flood Guidance	Inches	Yes	No
ratio	Ratio: precip. / FFG	%	Yes	Yes
diff	Difference: precip. - FFG	Inches	Yes	Yes